Plague

Bioterrorism Agent Profiles for Health Care Workers

Causative Agent: Plague is an acute bacterial disease caused by the gram-negative bacillus *Yersinia pestis*.

Routes of Exposure: Inhalation, Flea bite, Direct contact with infected blood and tissues

Infective Dose & Infectivity: 10-500 organisms

Incubation Period: The incubation period for pulmonary exposure ranges from 1 to 6 days with an average of 2-4 days.

Clinical Effects: Onset of pneumonic plague is acute and often fulminant. The presentation is one of high fever, cough, chest pain, malaise, hemoptysis, and muco-purulent or watery sputum with gram negative rods on gram stain. Chest X-ray should show evidence of bronchopneumonia. The pneumonia progresses rapidly, resulting in dyspnea, stridor and cyanosis. Gastrointestinal symptoms including nausea, vomiting, diarrhea and abdominal pain might also be present. Buboes (regional lymphadenopathy) are rarely seen. The terminal event of primary pneumonic plague is one of respiratory failure, circulatory collapse, and bleeding diathesis.

Laboratory testing: A presumptive diagnosis can be made microscopically by identification of the gram-negative coccobacillus with safety-pin bipolar staining in Gram or Wayson's stained smears from peripheral blood, sputum, or cerebrospinal fluids sample. When available, immunofluorescent staining is very useful.

1) Cultures of blood, sputum, and CSF, should be processed on blood agar, MacConkey agar or infusion broth. The organism grows slowly at normal incubation temperatures, and may be misidentified by automated systems because of delayed biochemical reactions. Identification of organism is done by DFA phage typing or PCR.
2) Antibody response test- A four-fold rise in antibody titer by ELISA or PHS in patient serum is also diagnostic.

Lethality: The mortality rate of untreated plague is 90-100%. However, with appropriate treatment, the mortality rate drops to 5%.

Transmissibility (person to person): Person-to-person transmission is possible via large aerosol droplets; transmission by droplet nuclei has not been demonstrated.

Primary contamination & Methods of Dissemination: Dissemination of plague would most likely be through aerosolization.

Secondary Contamination & Persistence of organism: *Y. pestis* is very sensitive to sunlight and heat and does not survive long outside of the host. Therefore**,** secondary contamination is not a concern.

Decontamination & Isolation:

Patients- Patients with suspected pneumonic plague should be managed with droplet precautions.

Equipment, clothing & other objects- Environmental decontamination can be done using a household bleach solution, with a contact time of 30 minutes prior to normal cleaning or washing.

Outbreak control: All patients with pneumonic plague should be isolated for the first 48 hours after the initiation of treatment. Strictly enforced respiratory isolation procedures must be followed, including gowns, gloves, and eye protection. Those who have been in household or face-to-face contact with patients with pneumonic plague should be given antibiotic prophylaxis and placed under surveillance for 7 days.

Personal Protective Equipment:

Prehospital: Gloves, eye protection, mask, gown
Health Care Facility: Droplet precautions

Treatment: Historically, the treatment of choice for bubonic, septicemic, and pneumonic plague has been streptomycin. However, as the drug is no longer readily available, gentamicin 5 mg/kg IM or IV once daily, or doxycycline 100 mg IV twice daily or ciprofloxacin* 400 mg IV twice daily can be used. In cases of suspected meningitis or in patients who are hemodynamically unstable, 'IV' chloramphenicol (50-75 mg/kg/day in four divided doses) should be added. Treatment should be continued for a minimum of 10 days or 3 to 4 days after clinical recovery. If clinically indicated, oral tetracycline can be used to complete a 10 day course of treatment after at least 5 days of systemic therapy.

Prophylaxis: Because of oral administration and relative lack of toxicity, the choice of antibiotics for prophylaxis or for use in face-to-face contacts of patients with pneumonic plague is doxycycline 100 mg po BID for 7 days or the duration of risk of exposure, whichever is longer. Tetracycline, 15-30 mg/kg, or chloramphenicol, 30 mg/kg, in four divided doses daily for one week after exposure ceases can also be used. Ciprofloxacin has also been shown to be effective in preventing disease in exposed mice.

Differential diagnosis: For pneumonic plague the differential diagnoses should include any acute pneumonia, tularemia, and anthrax.

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* Not an FDA approved indication